Executive Summary

Shoreline Change on the East Coast: Exploring the Role of the Shoreline Curvature

by
Jiahong Liu
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The low sloping sandy shoreline of the East Coast of the United States is a dynamic and complicated system that is affected by a series of factors. Previous work that has applied both qualitative and quantitative analyses has enhanced the understanding of shoreline change and has provided suggestions for coastal management. For decades, the United States Geological Survey (USGS) has conducted work to examine the factors that influence the local shoreline change rate. However, because the coastal system is so complex and various types of input information are required, the existing data in the USGS database may not be complete enough to address all the important factors.

This project focuses on the study of shoreline change in a way that differs in scope from existing work. The key variable discussed here is shoreline curvature, which has been mentioned in several examples in the literature as one of the factors influencing shoreline change rate. However, few quantitative research efforts have provided evidence to show the shoreline curvature's effect on the shoreline change rate. Moreover, shoreline curvature has not yet been incorporated into the USGS database as one of the variables for shoreline change.

This project report starts with a general introduction and background information regarding basic concepts, previous research, and the study region (the East Coast of the United States). Then, the report provides scientific explanations regarding the shoreline change process, followed by the data analysis methods, results, and discussion. Using the coastline contour data from the Global Self-consistent, Hierarchical High-resolution Geography (GSHHG) database in the National Geophysical Data Center, I have divided the coastline into several small pieces and constructed each of them into a series of equally spaced points (1 m). I then calculated the curvature of each point after applying smoothing processes (on 1-km, 3-km and 5-km spatial scale) on the resultant data to reduce the high-frequency undulation and keep the general trend of the coastline.

The results of the correlation analysis indicate a significant correlation between the shore curvature and the shoreline change rate for some locations. A previous study (Lazarus & Murray, 2007) has shown that, at one location, using short-term shoreline change rate data, correlations vary according to different time and spatial scales. This study, however, uses longer-term shoreline change rates (measured over recent decades) and has found the existence of significant correlations. The statistical significance of these correlations varies at different locations in Florida and North Carolina. Most of the significant coefficients were either greater than 0.1 or less than -0.1, whereas the less significant coefficients were generally between -0.1 and 0.1. These results are consistent with those from previous work of Lazarus and Murray (2007) and indicate widespread correlations between the shoreline curvature and shoreline change rate for different spatial scales and at different locations. This report also discusses some other influential factors of the study, including human activities and the complexity of the coastal system, and also put forward the direction of future direction.

Approved

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(MP adviser signature here)

___A. Brad Murray_____

Dr. (MP Adviser Name printed)

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Date

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